

## SUMMARY OF THE INVENTION

[0015] The invention comprises a carousel-based dispensing system for paper towels, in particular, which acts to minimize actual wastage of paper towels. The invention comprises means for holding and positioning at least first and second rolls of paper with respect to each other, means for dispensing paper from the first roll, means for dispensing paper from the first and second rolls simultaneously when the first roll reduces to a predetermined diameter of paper, means for positioning the depleted first roll for replacement without the necessity of removing the second roll and means for dispensing from the second and replacement rolls simultaneously when the second roll reduces to a predetermined diameter of paper.

[0016] A proximity sensor embodiment comprises a circuit according to a balanced bridge principle where detection is based on detecting a phase difference, which depends upon the amount of detected capacitance difference or change of capacitance in a region of detection.

[0017] A second embodiment of this invention comprises a second electronic proximity sensor. The second detector circuit is a miniaturized, micro-powered, capacitance-based proximity sensor designed to detect the approach of a hand to a towel dispenser. It features stable operation and a three-position sensitivity selector.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0018] For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

[0019] Figure 1 is a side elevation of the dispenser with the cover closed, with no internal mechanisms visible;

[0020] Figure 2 is a perspective view of the dispenser with the cover closed, with no internal mechanisms visible;

[0021] Figure 3 shows a view of the carousel support, the locking bar and the transfer bar;

[0022] Figure 4A is a perspective view of the of the dispenser with the carousel and transfer bar, fully loaded with a main roll and a stub roll;

[0023] Figure 4B is a side view of the locking bar showing the placement of the compression springs;

[0024] Figure 4C shows the locking mechanism where the locking bar closest to the rear of the casing is adapted to fit into a mating structure in the rear casing;

[0025] Figure 5 is a perspective, exploded view of the carousel assembly;

[0026] Figure 6A is a side elevation view of the paper feeding from the stub roll while the tail of the main roll is positioned beneath the transfer bar;

[0027] Figure 6B is a side elevation view of the stub roll is completely exhausted, so that the transfer bar tucks the tail of the main roll into the feed mechanism;

[0028] Figure 7A is a side elevation view of the carousel ready for loading when the main roll reaches a specific diameter;

[0029] Figure 7B is a side elevation view of the locking bar being pulled forwardly to allow the carousel to rotate 180°, placing the main roll in the previous stub roll position;

[0030] Figure 7C shows the extension springs which tend to maintain the transfer bar legs in contact with the stub roll;

[0031] Figure 7D shows the cleanable floor of the dispenser;

[0032] Figure 8A shows a schematic of the proximity circuit;

[0033] Figure 8B (prior art) shows the schematic for the National Semiconductor dual comparator LM393;

[0034] Figure 9A shows the square wave output at U1A, pin 1;

[0035] Figure 9B shows the RC exponential waveforms at pins 5;

[0036] Figure 9C shows the RC exponential waveforms at pin 6;

[0037] Figure 10 shows a schematic of a second proximity switch;

[0038] Figure 10A shows the asymmetric oscillator and the first static protection circuit;

[0039] Figure 10B shows the antenna, the antenna reset circuit, a second static protection circuit, the antenna buffer unity follower circuit, and the peak detector circuit; and a peak detector circuit;

[0040] Figure 10C shows the low pass filter for rejecting 50/60 Hz, the amplifier circuit, and the test points for adjusting VR1 to 3.0 V with all external capacitance-like loads in place;

[0041] Figure 10D shows the auto-compensate capacitor, the 50/60 Hz reject capacitor, and the output comparator which will produce an output pulse for signals which have passed all the rejection tests; these tests designed to prevent spurious signals from setting off an output pulse; and

[0042] Figure 10E shows a sensitivity select switch and circuit.

#### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT**

[0043] The following description is of the best mode presently contemplated for carrying out the invention. This description is not to be taken in a limiting sense, but is merely made for the purpose of describing the general principles of the invention. The scope of the invention should be determined with reference to the claims.

[0044] An embodiment of the invention comprises a carousel-based dispensing system with a transfer bar for paper towels, which acts to minimize actual wastage of paper towels. As an enhancement and further development of a system for delivering paper towel to the end user in a cost effective manner and in as user-friendly manner as possible, an automatic means for dispensing the paper towel is desirable, making it unnecessary for a user to physically touch a knob or a lever. An electronic proximity sensor is included as part of the paper towel dispenser. A person can approach the paper towel dispenser, extend his or her hand, and have the proximity sensor detect the presence of the hand. The embodiment of the invention as shown here, is a system, which advantageously uses a minimal number of parts for both the mechanical structure and for the electronic unit. It has, therefore, an enhanced reliability and maintainability, both of which contribute to cost effectiveness.

[0045] An embodiment of the invention comprises a carousel-based dispensing system with a transfer bar for paper towels, which acts to minimize actual wastage of paper towels. The transfer bar coupled with the carousel system is easy to load by a service person; consequently it will tend to be used, allowing stub rolls to be fully utilized. In summary, the carousel assembly-transfer bar comprises two components, a carousel assembly and a transfer bar. The carousel rotates a used-up stub roll to an up position where it can easily be replaced with a full roll. At the same time the former main roll which has been used up such that its diameter is less than some  $p$  inches, where  $p$  is a rational number, is rotated down into the stub roll